Message

From: Raichel, Dan [draichel@nrdc.org]
Sent: 11/2/2021 3:23:58 PM
To: Messina, Edward [Messina.Edward@epa.gov]; nan.singhasemanon@cdpr.ca.gov; Jennifer Teerlink [jennifer.teerlink@cdpr.ca.gov]; Goodis, Michael [Goodis.Michael@epa.gov]; Morrison, Karen@CDPR [Karen.Morrison@cdpr.ca.gov]; Vogel, Dana [Vogel.Dana@epa.gov]; Wilbur, Donald [Wilbur.Donald@epa.gov]; Akerman, Gregory [Akerman.Gregory@epa.gov]; Arrington, Linda [Arrington.Linda@epa.gov]; Kiely, Timothy [Kiely.Timothy@epa.gov]; Aranda, Amber [aranda.amber@epa.gov]; Koch, Erin [Koch.Erin@epa.gov]; Reaves, Elissa [Reaves.Elissa@epa.gov]; Matuszko, Jan [Matuszko.Jan@epa.gov]; Anderson, Brian [Anderson.Brian@epa.gov]; Echeverria, Marietta [Echeverria.Marietta@epa.gov]; Rosenblatt, Daniel [Rosenblatt.Dan@epa.gov]; Aubee, Catherine [Aubee.Catherine@epa.gov]; Smith, Charles [Smith.Charles@epa.gov]; Overstreet, Anne [overstreet.anne@epa.gov]; Anderson, Neil [Anderson.Neil@epa.gov]; Chao, Julie - OCE-OPMP, Washington, DC [julie.chao@usda.gov]; Myers, Clayton - OCE, Washington, DC [clayton.myers@usda.gov]; Nesci, Kimberly [Nesci.Kimberly@epa.gov]; Kaul, Monisha [Kaul.Monisha@epa.gov]; Becker, Jonathan [Becker.Jonathan@epa.gov]; Wyatt, TJ [Wyatt.Tj@epa.gov]; Johnson, Hope [Johnson.Hope@epa.gov]; Suarez, Mark [Suarez.Mark@epa.gov]
CC: Sarah Hoyle [sarah.hoyle@xerces.org]
Subject: Thank You and Follow-Up on Neonicotinoid-Treated Seeds
Attachments: Neonics CA Petition - FINAL 9.23.20.pdf; Request for Reconisderation of Insecticide Treated Seed Petition 12.22.20.pdf

Dear Ed et al.,

It was great talking with you all last week. Thank you for taking the time.

As promised, we are following up with some information on risks regarding neonicotinoid-treated seeds, especially re: water contamination and invertebrate harms. Specifically, we are sending:

- A list of relevant, peer-reviewed studies with links (below, studies mentioned on call highlighted);
- The Xerces fact sheet on the threat that insecticide seed treatments pose to Midwestern waterways (here);
- An NRDC-commissioned report on neonicotinoid treated seed use in California (here); and
- Our petitions to DPR re: pesticide-treated seeds (attached).

In a nutshell, the studies show that seed treatments account for the vast majority of agricultural neonicotinoid use—having greatly driven up insecticide-treated acres and the total insect-toxic load (given neonicotinoids' high invertebrate toxicity, widespread use, and persistence). While total mass of leaching and runoff from treated fields may be small as a percentage of the mass applied to the seed, the aggregate size and impact of that offsite movement is great and likely accounts for a large portion of the neonicotinoids we see in water across the U.S., especially in heavy corn and soybean regions. Soil concentrations resulting from neonicotinoid seed treatment use also appear to negatively impact wild bee populations.

Hope that is helpful. Looking forward to continuing the conversation, and if you have any questions, please let us know.

Best,
Dan and Sarah

Use of Neonicotinoid-Treated Seeds and Movement/Impacts of Seed Treatments

Alford A.M., and C.H. Krupke. 2019. Movement of the Neonicotinoid Seed Treatment Clothianidin into Groundwater, Aquatic Plants, and Insect Herbivores. *Environmental Science & Technology* 53(24):14368-14372. https://doi.org/10.1021/acs.est.9b05025

"By analyzing samples collected from field lysimeters with liquid chromatography tandem mass spectrometry (LC-MS), this study reports the highest CLO concentrations within leachate following planting, with maximum concentrations occurring 4 weeks post-planting (3370 ng L^{-1}). This concentration is approximately 10× greater than previously reported CLO concentrations in streams/rivers and prairie wetlands, likely the result of reduced dilution and photolysis impacts."

DiBartolomeis, M., S. Kegley, P. Mineau, R. Radford, and K. Klein. 2019. An Assessment of Acute Insecticide Toxicity Loading (AITL) of Chemical Pesticides Used on Agricultural Land in the United States. *PLoS ONE* 14(8):e0220029. https://doi.org/10.1371/journal.pone.0220029

"We found a 48- and 4-fold increase in [Acute Insecticide Toxicity Loading] AITL from 1992 to 2014 for oral and contact toxicity, respectively. Neonicotinoids are primarily responsible for this increase, representing between 61 to nearly 99 percent of the total toxicity loading in 2014. The crops most responsible for the increase in AITL are corn and soybeans, with particularly large increases in relative soybean contributions to AITL between 2010 and 2014."

Douglas, M.R., D.B. Sponsler, E.V. Lonsdorf, and C.M. Grozinger. 2020. County-level analysis reveals a rapidly shifting landscape of insecticide hazard to honey bees (*Apis mellifera*) on US farmland. *Scientific Reports* 10:797. https://doi.org/10.1038/s41598-019-57225-w

"We found that the increase in oral toxic load was particularly acute in the Heartland and Northern Great Plains regions, which showed a 121-fold and 53-fold increase, respectively. We attribute this pattern to the increasing use of neonicotinoid seed treatments in corn and soybean (see Figs. 2c, 5c, S9). …Neonicotinoids accounted for the overwhelming majority of oral toxic load by 2012, and previous research showed that virtually all neonicotinoid use in corn and soybean is via seed application. These results are consistent with DiBartolomeis et al., which also found that neonicotinoid use in corn and soy was the primary driver of the observed increase in oral toxic load at the national scale."

Douglas MR, Tooker JF. 2016. Meta-analysis reveals that seed-applied neonicotinoids and pyrethroids have similar negative effects on abundance of arthropod natural enemies. *PeerJ* 4:e2776. https://pubmed.ncbi.nlm.nih.gov/27957400/

"Our meta-analysis of nearly 1,000 observations from North American and European field studies revealed that seed-applied neonicotinoids reduced the abundance of arthropod natural enemies similarly to broadcast applications of pyrethroid insecticides. These findings suggest that substituting pyrethroids for seed-applied neonicotinoids, or vice versa, will have little net affect on natural enemy abundance"

Frame, S.T., K.A. Pearsons, K.R. Elkin, L.S. Saporito, H.E. Preisendanz, H.D. Karsten, and J.F. Tooker. 2021. Assessing surface and subsurface transport of neonicotinoid insecticides from no-till crop fields. *Journal of Environmental Quality* 50:476-484. https://doi.org/10.1002/jeq2.20185

"Assuming a 1.09% mass loss to water and a range of application rates of neonicotinoids to seeds of 0.25–0.50 mg seed−1, there is an annual potential for over 90–180 kg of neonicotinoids to enter aquatic environments throughout Pennsylvania. Extrapolated over the entire United States, this large amount could lead to long-term environmental, and possibly human, health problems (Cimino, Boyles, Thayer, & Perry, 2017; Goulson, 2014), particularly if neonicotinoid-treated corn and soybean are planted annually, which was not the field history in our study."

Hitaj, C., D. Smith, A. Code, S. Wechsler, P. Esker, and M. Douglas. 2020. Sowing Uncertainty: What We Do and Don't Know about the Planting of Pesticide-Treated Seed. *BioScience* 70(5):390–403. https://doi.org/10.1093/biosci/biaa019

"[T]here is a high degree of uncertainty about the extent of acreage planted with treated seeds, the amount of regional variability, and the use of certain active ingredients. One reason for this uncertainty is that farmers are less likely to know what pesticides are on their seed than they are about what pesticides are applied conventionally to their crops. . . .

As seed manufacturers have increasingly bundled seed characteristics, including genetically engineered traits and multiple pesticide active ingredients, into standardized seed packages, farmers may end up purchasing a seed that has more pesticide active ingredients than they want. . . . We find some evidence for the overuse of pesticides in farmers' inability to accurately recall the types of pesticides applied to their seeds, because the ability to recall is, in theory, related to the importance of the pesticide to the farmer for production."

Main, A.R., E.B. Webb, K.W. Goyne, and D. Mengel. 2020. Reduced species richness of native bees in field margins associated with neonicotinoid concentrations in non-target soils. *Agriculture, Ecosystems and Environment* 287:106693. https://doi.org/10.1016/j.agee.2019.106693

"Neonicotinoid concentrations in margin soils were negatively associated with native bee richness ($\beta = -0.21$, $P < 0.05$). Field margins with a combination of greater neonicotinoid concentrations in soil and fungicides in wildflowers also contained fewer wild bee species ($\beta = -0.21$, $P < 0.001$). By comparison, bee abundance was positively influenced by the number of wildflower species in bloom with no apparent impact of pesticides. Results of this study indicate that neonicotinoids in soil are a potential route of exposure for pollinator communities, specifically ground-nesting species. Importantly, native bee richness in non-target field margins may be negatively affected by the use of neonicotinoid seed treatments in agroecosystems."

Main, A.R., E.B. Webb, K.W. Goyne, R. Abney, and D. Mengel. 2021. Impacts of Neonicotinoid Seed Treatments on the Wild Bee Community in Agricultural Field Margins. *Science of The Total Environment* 786:147299. https://doi.org/10.1016/j.scitotenv.2021.147299

"Our study indicates that field-measured declines in bee communities over two years may be associated with annual application or persistence of neonicotinoids in agricultural fields and specifically exposure of wild bees to pesticides in soil."

Rundlöf M, G.K.S. Andersson, R. Bommarco, L. Fries, V. Hederstrom, L. Herbertsson, O. Jonsson, B.K. Klatt, T.R. Pedersen, J. Yourstone and others. 2015. Seed Coating with a Neonicotinoid Insecticide Negatively Affects Wild Bees. *Nature* 521:77–80 https://doi.org/10.1038/nature14420

"Here we show that a commonly used insecticide seed coating in a flowering crop can have serious consequences for wild bees. In a study with replicated and matched landscapes, we found that seed coating with . . . clothianidin and the non-systemic pyrethroid b-cyfluthrin, applied to oilseed rape seeds, reduced wild bee density, solitary bee nesting, and bumblebee colony growth and reproduction under field conditions. Hence, such insecticidal use can pose a substantial risk to wild bees in agricultural landscapes, and the contribution of pesticides to the global decline of wild bees may have been underestimated. The lack of a significant response in honeybee colonies suggests that reported pesticide effects on honeybees cannot always be extrapolated to wild bees."

Neonicotinoid Water Contamination Generally

Berens, M., P. Capel, and W. Arnold. 2021. Neonicotinoid insecticides in surface water, groundwater, and wastewater across land-use gradients and potential effects. *Environmental Chemistry* 40(4):1017–1033. https://doi.org/10.1002/etc.4959

"[T]he larger decrease of neonicotinoid concentrations in rivers and streams indicates the influence of agriculture, in which neonicotinoids are primarily applied as seed coatings only during planting. The more consistent neonicotinoid concentrations in lakes, which were all in urbanized watersheds, likely occurred from use on lawns, gardens, and trees applied throughout the growing season. As a result, urban watersheds are more likely to experience low-level chronic neonicotinoid exposure throughout the growing season, whereas agricultural watersheds are more likely to experience higher concentration spikes at the start of the growing season, followed by steady declines."

Hladik, M., D. Kolpin, and K. Kuivila. 2014. Widespread occurrence of neonicotinoid insecticides in streams in a high corn and soybean producing region, USA. *Environmental Pollution* 193:189–196. https://doi.org/10.1016/j.envpol.2014.06.033

"Neonicotinoids were detected at all nine sites sampled even though the basin areas spanned four orders of magnitude. Temporal patterns in concentrations reveal pulses of neonicotinoids associated with rainfall events during crop planting, suggesting seed treatments as their likely source."

Hladik, M., S. Corsi, D. Kolpin, A. Baldwin, B. Blackwell, and J. Cavallin. 2018. Year-round presence of neonicotinoid insecticides in tributaries to the Great Lakes, USA. *Environmental Pollution* 235:1022–1029. https://doi.org/10.1016/j.envpol.2018.01.013

"Neonicotinoid concentrations generally increased in spring through summer coinciding with the planting of neonicotinoid-treated seeds and broadcast applications of neonicotinoids."

Schepker, T., E. Webb, D. Tillitt, and T. LaGrange. 2020. Neonicotinoid Insecticide Concentrations in Agricultural Wetlands and Associations with Aquatic Invertebrate Communities. *Agriculture, Ecosystems & Environment* 287:106678. https://doi.org/10.1016/j.agee.2019.106678

"Although neonicotinoids were below benchmark concentrations proposed by government regulations, a significant negative association between neonicotinoid concentrations and aquatic invertebrate biomass was observed across all wetlands studied."

DANIEL RAICHEL
Staff Attorney, Wildlife
Nature Program

NATURAL RESOURCES DEFENSE COUNCIL

C 773.319.6376
DRAICHEL@NRDC.ORG
NRDC.ORG

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